Status and Outlook of China’s Engineering Education

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Outline

I. Achievements made in China’s engineering education in recent years.

II. Problems and weakness in China’s engineering education

III. Outlook for the development of China’s engineering education
I. Achievements made in China’s engineering education in recent years

• i. Fast expansion of educational scale
  – From 2000 to 2010, the number of enrolled undergraduates and junior college students grew by 12% annually on average to 6.618 million in 2010
  – the total number of on-campus students at 22.318 million
  – The number of engineering students with newly enrolled ones accounts for one third of the total
  – China’s engineering students top the list in the total both in terms of the number and the ratio
  – The young people receive higher engineering education, which lays foundation for the labor demand in the process of China’s industrialization
I. Achievements made in China’s engineering education in recent years. (continued 1)

- Chart 1  Enrollment of regular higher education for universities and junior college

<table>
<thead>
<tr>
<th></th>
<th>number of new students (in millions)</th>
<th>among which, the number of engineering students</th>
<th>total on-campus students</th>
<th>among which, the number of engineering students</th>
</tr>
</thead>
<tbody>
<tr>
<td>year of 2000</td>
<td>2.206</td>
<td>0.832</td>
<td>5.561</td>
<td>2.148</td>
</tr>
<tr>
<td>year of 2010</td>
<td>6.618</td>
<td>2.412</td>
<td>22.318</td>
<td>8.031</td>
</tr>
<tr>
<td>average annual growth rate</td>
<td>12%</td>
<td>11%</td>
<td>15%</td>
<td>14%</td>
</tr>
<tr>
<td>among which the average annual growth rate in the first five years</td>
<td>18%</td>
<td>17%</td>
<td>23%</td>
<td>20%</td>
</tr>
</tbody>
</table>

- By the year of 2010, the gross admission ratio of higher education had reached 26.5%.
I. Achievements made in China’s engineering education in recent years. (continued 2)

• ii. Positive changes in the educational structure
  1. The renewed focus on vocational education.
     – in the 1990s, the vocational education, for a variety of reasons, was weakened and ignored by the society.
     – This situation has been greatly changed recently. The central government refocused on vocational education.
     – The year of 2010, 3.105 million were enrolled into the higher vocational institutes, accounting for 47% of whole newly enrolled, among which the engineering students totaled 1.297 million,
  2. Positive changes also take place in degree education.
     – The degree of professional master based on application and practice has been approved and seen rapid development, among which the engineering masters take up the largest proportion
     – In 2010, the enrollment number for professional degree was 245,000, accounting for 41% and of them, 115,000 were applying for engineering masters,
I. Achievements made in China’s engineering education in recent years. (continued 3)

• iii. Educational expense is growing dramatically.
  – By the year of 2009, the education expense had reached RMB1650.27 billion nationwide about 256B.usd, increasing by 329% over that in 2000 and at the annual growth of 18% on average over the past ten years.

• iv. Educational quality is improving.
  – Some new majors have been launched.
  – included engineering ones, like environmental science and engineering, information, new materials, new energy and energy conservation, aeronautics and astronautics as well as oceanographic engineering, etc.
  – the engineering teaching is added by new contents of social science and human science, like economics, law and ethics, etc.
  – combination of theory and practice is also under way.
I. Achievements made in China's engineering education in recent years. (continued 4)

• v. Educational reform is going well.
  – The new teaching model highlights needs determination and students’ value orientation, the comprehensive engineering training and the overall reform on the curriculum system guided by practice. The concepts of CDIO and PBL teaching model reforms are introduced from abroad, but innovated in localization.

• vi. International cooperation is advancing.
  – connection with foreign schools in various ways, from irregular to regular exchange visits, exchanges of experience, students and visiting scholars, to cooperative school running, mutual recognition of degree to joint awarding of degree.
  – China’s universities and colleges expand their enrollment scale for international students. Right now, the number of on-campus overseas students has exceeded 120,000, up by over 50% during the period of eleventh five-year plan.
II. Problems and weakness in China’s engineering education

• i. Contradiction between supply and demand
  – on one hand, a significant part of universities graduates found it difficult to find a job. on the other hand, many enterprises could not find persons they need,
  – Both total amount and structure.
  – the annual growth rate of employment in the second and tertiary industries stands only at 4.5% the number of graduates every year grows by double digits.
  – In terms of structure, both the hierarchical structure and the major’s structure have something inconsistent. The vocational education still has problems with guidance of public opinion.
  – many emerging majors, or inter-discipline majors are still lacking in numbers.
II. Problems and weakness in China’s engineering education (continued 1)

• ii. Schools’ development goals and models are getting assimilated.
  – Because administrative management by level is conducted on universities and colleges, higher education institutions were divided higher vocational schools, general schools and 211 schools, 985 schools, academic, teaching-academic and teaching schools.
  – first-class universities and non-first-class universities,
  – this hierarchy is closely linked to a school’s and school leaders’ level, and to financial and other supports for a school as well.
  – every school wants to be the first-class academic university, which will lead to the assimilation of school’s development goals and models.
  – the goal of nurturing diversified talents for the social needs is becoming vague; the goal of taking nurturing talents as the major task of schools is becoming vague too.
II. Problems and weakness in China’s engineering education (continued 2)

• iii. Lack of practice in learning.
  – the experimental conditions of universities are seriously weakened.
  – schools have weak link with enterprises, students have very few chances to go to the enterprises for practice.
  – there are a limited number of large enterprises, which make them unable to accept so many intern students.
  – The design part has to be cancelled now. The graduation design has been replaced by graduation thesis.
II. Problems and weakness in China’s engineering education (continued 3)

• iv. The curriculum is not orientated towards the engineering features.
  – three types of courses - fundamental courses, fundamental major courses and major courses, which is short of changes adapted to the modern engineering features.
  – according to the concept of science education,
  – based on reductionism and lack in systematic and comprehensive thinking of engineering.
II. Problems and weakness in China’s engineering education (continued 4)

• **v. Students are short of capabilities and ethics**
  
  – lack skills of correct thinking and inter-personal communication, both in middle schools or at universities, the logic course and the communication course are not available.
  
  – the misconduct and unhealthy customs and practice in the social and academic circles will definitely exert negative influence on students, causing them to be void of independent personality and the spirit of seeking the truth.
III. Outlook for the development of China’s engineering education

• National Guideline on Medium- and Long-term Educational Reform and Development Planning 2010-2020
  – every part of the guideline can exert influence on engineering education

• i. School competition will get fiercer and the supply-demand problem for engineering talents will be eased.
  – the total number of participants in the national college entrance examination began to decline in recent years.
  – that competition among schools will become increasingly intense.
  – Some low-quality schools without characteristics will be eliminated, but most of the schools will make progress.
III. Outlook for the development of China’s engineering education (continued 1)

• ii. Schools’ efforts to develop will depend on reforms on the engineer system and administrative system of running school.
  – First, the guiding role of engineers’ professional qualification will be approved in the near future.
  – Second, changes must be brought about on the connection between schools’ classification and their administrative level and resources in a bid to dissolve schools’ motive power for assimilation.

• iii. Industrial transformation will help solve the problems about nurturing talents by combining production with academic learning.
  – Production-learning integration and school-enterprise cooperation. This requires the legislation efforts so that enterprises can identify their social responsibility in nurturing talents;
  – schools should organize students to take practical activities in the enterprises in order to create a win-win situation that enterprises can benefit from while students can learn something meaningful.
III. Outlook for the development of China’s engineering education (continued 2)

• iv. Teachers will become the main force in the teaching reform.
  – the major force of reform is teachers, but potential resistance also comes from teachers.
  – concepts like CDIO and PBL, etc. should be fully understood, digested and absorbed in reference to the actual situation.
  – the plan of nurturing outstanding engineers.
III. Outlook for the development of China’s engineering education (continued 3)

- v. Students’ all-round qualities should be improved through efforts in various aspects.
  - The course of ethics nurturing should be improved from the perspective of talents’ overall growth and should penetrate into the activities of students at school so that students can develop independent personality and good quality and character while forming their correct views of world, life and the value system.
  - Courses as engineering ethics, logic thinking and interpersonal communication, extra-curricular activities, social activities should be organized to offer students opportunities to contact the society.
  - Understanding that everybody can be qualified and every sector is needed in the society.
  - Short-term efforts are far from enough for the realization of these goals.
  - To include some basic engineering knowledge besides science knowledge into the teaching contents of elementary and middle schools is much needed.
The points illustrated above include both short-term tasks and long-term efforts direction. As China pushes forward its modernization program, the quality of engineering education will inevitably improve and must be boosted with a view to nurturing generations of qualified engineering persons tailored to the needs of national development.

Thanks!

Questions & Comments